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Forecasting Profitability, Earnings, and Corporate Taxes: Evidence from UK Companies

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FORECASTING PROFITABILITY, EARNINGS, AND CORPORATE TAXES: EVIDENCE FROM UK COMPANIES

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Abstract

This paper follows the Fama-MacBeth (1973) methodology to test the hypothesis that, under competition, profitability reverts to its mean and that, like profitability, earnings are also predictable. The predictability of earnings is then used to estimate changes in corporate taxes from one year to another. The evidence from nearly 13,000 listed and non-listed UK firms supports the extant view that changes in profitability and earnings are predictable. We provide separate estimates for three industrial sectors. In a simple partial adjustment model, we find that profitability of UK companies reverts towards the firm specific mean at a rate of 19% per year for firms engaged in computer consultancy, 24% for hotels and restaurants, and 27% for the transport manufacturing sectors. Thus, the intensity of intra-industry competition and the industry characteristics may be important in explaining differences in the rates of mean reversion across industrial sectors. There are, however, no significant differences in the patterns of mean reversion across sectors. The study further shows that the predictable variation in earnings is attributable mainly to mean reversion in profitability. We find that changes in corporate taxes follow an autoregressive process and that changes in taxes are driven by changes in earnings. We thus show that the notion of mean reversion of profitability is a useful one for forecasting taxes as well as earnings.

Key Words: Forecasting, profitability, earnings, corporate taxes

JEL classification: G12, H25

Forecasting Profitability, Earnings, and Corporate Taxes: Evidence from UK Companies

1. Introduction

There is a strong presumption in economic theory that, under competition, profitability (the rate of return on investment) tends towards an equilibrium level in all industries (Stigler, 1963, p.54). In the dynamic vision of the capitalist process[1], competitive pressure prompts "internal and external restructuring"[2] of firms. Internal restructuring means that productivity increases due to changes initiated within existing enterprises. Competition brings to bear downward pressure on costs and increases incentives for the efficient organisation of production, encouraging innovation aimed at reducing slack and increasing profitability. External restructuring refers to the process of market selection whereby lower productivity establishments exit and are replaced by higher productivity entrants, while higher productivity incumbents gain market share. The prospect of failure or takeover encourages firms with low profitability to allocate resources to more productive uses.

These arguments imply that in a competitive environment profitability should revert to its mean within as well across industries. The notion that profitability is mean reverting further implies that changes in profitability and earnings are to some extent predictable. There is a large literature, mostly in accounting, on the predictability of variations in earnings. A smaller literature (Beaver, 1970; and Ball and Watts, 1972) examines both profitability and earnings. However, Fama and French (2000), for the first time, explicitly examined the links between the predictability of profitability and the predictability of earnings. To them, much of what is predictable about earnings is due to the mean reversion of profitability. They provide evidence to substantiate this hypothesis. Using a simple partial adjustment model, they estimated a rate of mean reversion of about 38% per year for the US listed companies. Recently, Allen and Salim (2002) have replicated the work of Fama and French to test the mean reversion hypothesis on a sample of 987 UK firms listed on stock market for the 1982-2000 period. They found convergence towards the mean at a rate of about 25% per year.

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[1] Schumpeter, J.A. (1943, p.83) describes the process he termed "creative destruction", as: "The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organisation that capitalist enterprise creates…[This is a] process of industrial mutation –if I may use that biological term – that incessantly revolutionaries the economic structure *from within*, incessantly destroying the old one, incessantly creating new one. This process of Creative destruction is the essential fact about capitalism".

[2] Disney R., Haskel, J. and Heden, Y. (2003)

This paper extends Fama and French (2000) (here-in-after referred to as FF) in examining the mean reversion hypothesis for UK. Our extensions are in the following:

(1) We examine mean reversion of profitability and earnings changes for both listed and non-listed firms. While the expected profitability of firms quoted on stock exchange is strongly influenced by dividends and market-to-book values, non-listed firms have different sources of information for expected profitability. In this study, we tailor the model to address the differences between listed and non-listed companies in explaining the level of profitability for each firm. Thus, in addition to dividends, size, market-to-book value, and capital intensity, used by Fama and French (2000), we introduce variables representing organisational structure, funding structure, liquidity and capital productivity into the model to obtain the information about each firm's expected profitability. These variables affect company profitability significantly.

(2) Unlike studies of Fama and French (2000) and Allen and Salim (2002) we provide separate estimates for three diverse industrial sectors which take listed companies as undifferentiated population. The industries we examine are hotels and restaurants, transport manufaturing and computer consultancy. The intuition behind this is that the intensity of competition in different industries is likely to yield different rates and patterns of mean reversion of profitability.

(3) If predictability of earnings is due largely to the mean reversion of profitability then it has important implications for the real-world forecasts of earnings by security analysts and the forecasts of corporate tax receipts by the tax authorities and the treasury. With this in mind, we extend our analysis to forecast corporate tax liabilities. In our partial adjustment model of corporate taxes, we follow the Fama-MacBeth methodology and draw inferences on the basis of average slopes and standard errors obtained from year-by-year regressions. Thus, we aim to fill a gap in the literature and examine the links between changes in profitability and earnings and the predictability of corporate taxes.

This paper is organised as follows. Section 2 provides a background discussion and reviews some of the issues relating to the predictability of profits and earnings. It also provides estimates of a simple partial adjustment model for profitability in which the rate of mean reversion is a constant. Then, it allows for non-linear mean reversion. Section 3 estimates for predictable variations in earnings. Section 4 examines changes in corporate tax liabilities of the firms, and section 5 offers concluding remarks.

2. Forecasting Profitability

The foundations of much of the work on forecasting profitability is the notion that under competition profitability will tend to revert to its mean.

2.1 Literature review

In their recent study, Fama and French (2000) find that profitability reverts to its mean at the rate of 38% per annum in the US, and that changes in earnings are to a large extent predictable. Whilst they are not the first ones to provide evidence on corporate profitability and earnings changes, their approach produces more reliable evidence than the earlier studies which had three main limitations: (a) Some previous studies on predictability (Beaver,1970; Brooks and Buckmaster, 1976) carried out no formal tests. (b) Most studies of predictability of earnings and profitability, where formal tests were provided, are based on time series modelling of individual firms. This necessarily limits the sample to firms with long earnings history to enhance the power of the tests. This approach has two disadvantages. First, data of firms with long history of earnings produces survival bias and, second, although 20 years is a long period in a firm's life, 20 observations on annual earnings are not sufficient to produce precise estimates in a time-series model. Accordingly, the evidence on predictability of earnings in such studies, though economically interesting, is statistically weak. Notable examples are Lev (1969), and Freeman, Ohlson, and Penman (1982). (c) Some previous studies also employed cross-section regressions dealing with changes in profitability or earnings on lagged changes and other variables. The advantage of cross-section regressions is that they can use large samples to provide power with minimal survivor bias. However, the standard errors of the regression slopes in the cross-section tests are not usually adjusted for the correlation of regression residuals across firms. With the exception of Elgers and Lo (1994), earlier cross-sectional studies (e.g. Freeman et al. 1982; Collins and Kothari 1989; Easton and Zmijewski, 1989; Ou and Penman, 1989; and Basu, 1997) were based on the assumption that there is no correlation across firms in current changes in profitability and earnings; this is untenable in the face of macroeconomic or industry specific shocks.

Fama and French (2000) adopt the Fama-MacBeth methodology (1973) to forecast profitability and earnings with year-by-year cross-section regressions, and use the average slopes and time series standard errors to draw inferences. This approach has two main advantages: (a) It allows large samples to be used to enhance the power of tests, and (b) the year-by-year variation in the slopes, which determine the standard errors of the average regression coefficients, includes the effects of estimation error due to the correlation of the residuals across firms. They find that mean reversion (which averages 38% per year) is faster when profitability is below its mean and also when it is further from its mean in either direction. Furthermore, they show that mean reversion in profitability produces predictable variations in earnings.

Allen and Salim (2002) replicated the work of Fama and French on a sample of 987 UK firms listed on stock market for 1982-2000 period. Their results were similar to those of FF (convergence towards the mean at a rate of about 25% per year) but they did not find significant non-linearities in the mean reversion of profitability or in the autocorrelation of changes in earnings.

Apart from the above recounted accounting and finance literature, there is a parallel, well-established literature in economics which measures the intensity of competition for an economy or an industry in terms of the persistency of firm profitability. The simple intuition behind this methodology is the view that *ceteris paribus*, the more intense the competition in an industry, the lower is likely to be the persistence of corporate profitability over time in industry. Companies may earn monopoly rents for temporary advantage, howsoever acquired whether through monopoly power or prudent management, such profits will not persist for long in competitive markets. This argument implies that profitability would eventually revert to its mean within and across industries. In his pioneering work, Mueller (1977) using a series of firm specific regressions employing US data, showed that profitability frequently followed a deterministic, decaying time trend, suggesting a tendency for profit rates of different firms to converge over time. Subsequently, Mueller (1986) used a stochastic approach, modelling profitability as a first order autoregressive process. Geroski and Jacquemin (1988) estimated a stochastic persistence model using European data and Mueller (1990)'s edited volume presented evidence for a number of countries. Recently, Goddard and Wilson (1999) estimated a persistence of profit model for UK manufacturing firms. Glen and Singh (2002) present time-series analyses of corporate profitability in seven leading developing countries using the methodology of the persistence of profitability and systematically compare the results with those of advanced countries.

2.2 Research Methodology

In order to forecast profitability, we adopt a three-step approach followed by Fama and French (2000). The first step involves a model that explains the level of profitability. This provides estimates of expected profitability of each firm. In the second step, we estimate, for each year from 1992 to 2002, a simple cross-section partial adjustment model for the change in profitability from t to $t+1$ which uses information on the expected value of the profitability obtained from regressions carried out in the first step. The third step involves relaxing the linear adjustment assumption to introduce non-linearities, and provide more insight into the behaviour of profitability.

Inferences are drawn from the time series means of slopes and their time series standard errors of the cross-sectional regressions. The methodology has two main advantages: it adjusts the standard errors of the regression slopes in cross-section estimations for the correlation of regression residual across firms. The year-by-year variation in the slopes, which determines the standard errors of the average slopes, includes the effects of estimation errors due to the correlation of residuals across firms (Fama and French, 2000). The average slopes from such year-by-year cross-section regressions are equivalent to the slopes from pooled time-series cross-section regressions that include annual dummies to allow the average values of the variables to change through time.

Fama and French (2000) use data set for 33 years (1964 to 1995) with the number of firms in their *sample* averaging at 2,343 per year. In contrast, we use data (from the Fame database) on the *population* of UK firms in three specific sectors, namely hotel and restaurants, business services (computer consultancy) and transport manufacturing from 1992 to 2002. These sectors span a range of characteristics, such as size, activity, barriers to entry (technology, raw material availability, spatial configuration, buying practices and legal environment etc.), capital intensity and concentration. There are 3006 firms in the hotels and restaurants sector, 1244 firms in the computer consultancy and 2040 firms in the transport manufacturing sectors averaging per year in our sample. The greater size of dataset will provide more power and reduce survivor bias. The estimations are carried out separately for each sector. The time period is sufficiently longer enough to capture the effects of at least one business cycle on the performance of firms.

- ***Regressions to explain the level of profitability***

In order to forecast firm profitability, we need to first determine their expected profitability based on their characteristics. Fama and French (2000), in their study of the US stock markets, use three variables to estimate differences across firms in expected profitability in the first stage regressions:

(i) *the ratio of year t dividends to book value of common equity*, relying on the hypothesis that dividends have information about expected earnings because firms target dividends to the permanent component of earnings (Miller and Modigliani, 1961).

(ii) *a dummy* variable to capture any non-linearity in the relation between dividends and expected profitability.

(iii) *the market-to-book ratio*, to capture variation in expected profitability missed by the dividend variables. Since the market value of a firm is the current value of all future net cash flows, this proxy is included in the estimation of one of the sectors (transport manufacturing) where there are considerable observations on this variable.

Fama and French (2000) limit themselves to listed companies and explain expected profitability of firms in their sample by using the above three variables. For private limited companies and unincorporated businesses with no outside shareholding, the variables on dividend and market value of the firms are not available. We vary the FF model to render it applicable to non-listed companies. We use the following additional variables to explain expected profitability of the firms in our model[3]:

(1) *Size* (commonly proxied by log of total assets). Fama and French (2000) found this statistically insignificant for listed firms.

(2) *Capital intensity* (defined as the depreciation/total assets). Fama and French (2000) found this statistically insignificant for listed companies.

(3) *Gearing***,** representing funding structure of the company, commonly known as debt to equity ratio (total liability/shareholders fund).

(4) *Capital productivity***,** a key performance indicator for the firm, is calculated by dividing sales with capital employed. The capital employed is the sum of working capital and fixed assets.

(5) *Current ratio*, defined as the ratio of current assets to current liabilities. This ratio reflects debt sustainability of a firm and is a measure of liquidity.

[3] Economy-wide studies include the following variables as determinants of profitability: **Concentration**, defined as the proportion of industry income accounted for by the largest 4 (or 5) firms in the industry. This is used in macroeconometric studies. **Market share,** taken as the total income of the individual firm as a percentage of industry revenue. **Barriers to entry,** depends on industry characteristics, e.g. technology, raw material availability, spatial configuration, buying practices and legal environment. Since it is very subjective in nature, empirical literature rarely uses this measure.

(6) *Organisational structure*, proxied by the number of subsidiaries and holdings. Firms may use complex organisational structures to tunnel resources from one entity to another in different locations/industries/performance classes, primarily for tax purposes, this variable can pick up the variations in expected profitability across firms significantly.

The estimate of expected profitability in each year, *t*, is the fitted value from the following regression:

$$Y_{it} / A_{it} = \alpha_{0,t} + \alpha_{1,t} DIV_{it} + \alpha_{2,t} DD_{it} + \alpha_{3,t} A_{it} + \alpha_{4,t} CAPIN_{it} + \alpha_{5,t} GEAR_{it} + \alpha_{6,t} CUR_{it}$$
$$+ \alpha_{7,t} CPR_{it} + \alpha_{8,t} SUB_{it} + \alpha_{9,t} HOLD_{it} + \alpha_{10,t} (V_{it} / A_{it}) + \varphi_{it} \quad (1)$$

A_{it} is a firm's total book assets at the end of year t; Y_{it} is earnings before taxation; (Y_{it} / A_{it}) is the return on assets (a measure of profitability); DIV_{it} is the dividend as a ratio of book value of common equity paid out by the *i*th firm during period *t; DD_{it}* is a dummy that is 0 for dividend payers and 1 for non-payers in period *t*.; $CAPIN_{it}$ is the capital intensity of firm at the year *t* end; $GEAR_{it}$ is gearing (debt/equity ratio); CUR_{it} is the current ratio; CPR_{it} is capital productivity; SUB_{it} and $HOLD_{it}$ are the number of subsidiaries and holdings respectively, and (V_{it} / A_{it}) is the market-to-book ratio (Tobin's q) for each firm in the year *t*. To ensure that in the presence of significant heterogeneity of firm sizes the outliers do not influence the results, the variable on size of the firms is used in log form instead of levels.

- ***A simple partial adjustment model for profitability***

Following Fama and French (2000), we estimate, for each year t from 1992 to 2002, a simple partial adjustment model for the change in profitability (measured as the year t return on assets) from t to $t+1$.

$$Y_{i,t+1} / A_{i,t+1} - Y_{i,t} / A_{i,t} = \beta_{0,t} + \beta_{1,t} [Y_{i,t} / A_{i,t} - E(Y_{i,t} / A_{ti,})] + \beta_{2,t} [Y_{i,t} / A_{i,t} - Y_{i,t-1} / A_{i,t-1}] + \varepsilon_{t+1}$$

(2a)

The equation (2a) can be re-written as:

$$CP_{i,t+1} = \beta_{0,t} + \beta_{1,t} DFE_{i,t} + \beta_{2,t} CP_{i,t} + \varepsilon_{t+1} \quad (2b)$$

$E(Y_{i,t}/A_{i,t})$ is the expected value of profitability of firm *i*; $CP_{i,t} = Y_{i,t}/A_{i,t} - Y_{i,t-1}/A_{i,t-1}$ is the change in profitability from $t-1$ to t; and $DFE_{i,t} = Y_{i,t}/A_{i,t} - E(Y_{i,t}/A_{i,t})$ is the deviation of profitability from its expected value; and $\varepsilon_{i,t+1}$ is the error term for year *t*+1.

To see how the estimates of (2) change if we assume all firms revert towards one overall equilibrium level of expected profitability, we estimate the following equation:

$$Y_{i,t+1}/A_{i,t+1} - Y_{i,t}/A_{i,t} = \beta_{0,t} + \beta_{1,t}(Y_{i,t}/A_{i,t}) + \beta_{2,t}(Y_{i,t}/A_{i,t} - Y_{i,t-1}/A_{i,t-1}) + \varepsilon_{t+1} \quad (3)$$

In equation (3), profitability reverts to the grand mean at the rate $-\beta_1$.

- ***A non-linear partial-adjustment model for profitability***

Brooks and Buckmaster (1976) show that changes in earnings are likely to reverse from one year to the next, the reversals are stronger for extreme changes of either sign, and they are stronger for negative changes. Elgers and Lo (1994) formally confirm the last result of the earlier study on changes in earnings. Since the predictability of earnings is expected to be largely due to mean reversion in profitability, Fama and French (2000), in the third stage, expand the partial adjustment model to test whether there is a non-linearity in the behaviour of profitability. To this end, we estimate the following equation:

$$\begin{aligned} CP_{t+1} = {} & \gamma_{0,t} + (\gamma_{1,t} + \gamma_{2,t} NDFED_{it} + \gamma_{3,} NDFED_{it} * DFE_{it} + \gamma_{4,t} PDFED_{it} * DFE_{it}) DFE_{it} \\ & + (\gamma_{5,t} + \gamma_{6,t} NCPD_{it} + \gamma_{7,t} NCPD_{it} * CP_{it} + \gamma_{8,t} PCPD_{it} * CP_{it}) CP_{it} + e_{i,t+1} \end{aligned} \quad (4a)$$

$$\begin{aligned} & = \gamma_{0,t} + \gamma_{1,t} DFE_{it} + \gamma_{2,t} NDFE_{it} + \gamma_{3,t} SNDFE_{it} + \gamma_{4,t} SPDFE_{it} \\ & + \gamma_{5,t} CP_{it} + \gamma_{6,t} NCP_{it} + \gamma_{7,t} SNCP_{it} + \gamma_{8,t} SPCP_{it} + e_{i,t+1} \end{aligned} \quad (4b)$$

where (for firm *i* and at the end of the year *t*) DFE_{it} is the deviation of profitability from its expected value; CP_{it} is the change in profitability from *t-1* to *t*.; and e_{t+1} is the error term for the year t+1.

$NDFED_{it}$, $PDFED_{it}$, $NCPD_{it}$ and $PCPD_{it}$ are dummy variables as follow:

$NDFED_{it}$ is 1 when DFE_{it} is negative, and zero otherwise;

$PDFED_{it}$ is 1when DFE_{it} is positive, and zero otherwise;

$NCPD_{it}$ is 1 when CP_{it} is negative, and zero otherwise;

$PCPD_{it}$ is 1 when CP_{it} is positive, and zero otherwise.

The derived variables in (4b) are:

$NDFE_{it}$ is DFE_{it}, when DFE_{it} is negative and zero otherwise;

$SNDFE_{it}$ is the square of DFE_{it}, when DFE_{it} is negative and zero otherwise;

$SPDFE_{it}$ is the square of DFE_{it}, when DFE_{it} is positive and zero otherwise;

NCP_{it} is CP_{it} when CP_{it} is negative and zero otherwise;

$SNCP_{it}$ is the square of CP_{it} when CP_{it} is negative and zero otherwise; and

$SPCP_{it}$ is the square of CP_{it} when CP_{it} positive and zero otherwise.

The coefficients $\gamma_{2,t}$, $\gamma_{3,t}$ and $\gamma_{4,t}$ measure the non-linearity in the mean reversion of profitability (the speed of adjustment of profitability to its expected value), while $\gamma_{6,t}$, $\gamma_{7,t}$ and $\gamma_{8,t}$ measure non-linearity in the autocorrelation of changes in profitability.

2.3 Mean-reversion of profitability: Results

Table 1 and 2 show the results of the average coefficients obtained from year-by-year cross section regressions of equations (1), (2), and (3) carried out for each year from 1992 to 2002 for the hotels and restaurants sector. The results on two other sectors, namely, transport manufacturing and computer consultancy have been presented in Appendix 1 and 2 respectively. The tables report the means (across years) of regression intercepts *(Int)* and slopes, and *t*-statistics for the means *t (Mn)*, defined as the mean divided by its standard error (time-series standard deviation of the coefficients divided by $(n)^{1/2.}$ It also reports the time averages of the means and standard deviations (across years) of the regression variables.

- ***Regressions to explain the level of profitability***

Table 1 below reports the results of the regressions to explain the level of profitability, (Y_{it} / A_{it}), for each firm. Three sets of equations are reported. In equation 1.1, we regress Y_{it} / A_{it} on the four variables included in the FF model; namely, DIV_{it} - dividend as a ratio of book value of common equity paid out by the *i*th firm during period *t;* DD_{it} - a dummy that is 0 for dividend payers and 1 for non-payers in period *t*.; A_{ti} - size of the firm represented by it's total book assets at the end of year t; $CAPIN_{it}$ - capital intensity of the firm at the end of year *t*;

In equation 1.2 we examine the model fit with organisational structure as an additional explanator for expected profitability. We include the number of subsidiaries SUB_{it} and holdings $HOLD_{it}$ as additional regressors. In equation 1.3 we add three important variables that capture the effect of funding structure (gearing), $GEAR_{it}$, debt-sustainability (current ratio), CUR_{it}, and capital productivity, CPR_{it}. These ratios are considered to contain information about expected profitability. We also find that for the larger firms in transport manufacturing sector (Appendix 1), we get a better fit if we include the market-to-book value ratio (Tobin's q), (V_{it} / A_{it}) in our model.

As pointed out by Fama and French (2000), the t-statistics from the cross-section regressions need to be interpreted with caution, as the autocorrelation in the slopes from the year-by-year regression poses a problem. In their dataset, they find first order correlations are high, around 0.5, and so they conclude that the variances of the average slopes, calculated assuming serial independence of the average slopes, are too small (by about 50%), and the standard errors of the average slopes should be inflated by about 40%. We interpret t-statistics exercising similar caution, however, t-statistics reported in table 1 are mostly above 3.00 except those for holdings and capital productivity. The positive average slope on DIV_{it} in equation 5.1.3 is 4.04 standard errors from zero. The highly significant negative average slope on DD_{it} confirms that the relation between profitability and dividend is non-linear; the expected profitability of firms that do not pay dividends is significantly lower (with t-statistic ranging between -4.64 to -6.33 in equation 1.1 to 1.3) than predicted by the relation between Y_{it} / A_{it} and DIV_{it}. Thus our results confirm the results of Fama and French (2000) and Allen and Salim (2002) regarding the strong relation between dividends and expected profitability. However equations 1.2 and 1.3 show that the additional variables capture variation in expected profitability missed out by the dividend variable. Both size and capital intensity have very high t-statistics, about 10.0

and 4.14 respectively. The slope on capital intensity is positive and that of the size is negative, suggesting that capital intensity improves expected profitability but the effect of size on expected profitability is negative. Since bigger firms typically have larger number of subsidiaries, it is interesting to examine the effect of higher number of subsidiaries on expected profitability. The results reported in table 1 (equations 1.2 and 1.3) show that the negative slope on number of subsidiaries is significant with t-statistic of –5.21, suggesting that the expected profitability of firms with complex organisational structures is lower than those of smaller ones. This conforms to the findings of Ahmed (2004) where organisational structure was found to be negatively associated with corporate tax receipts. Higher debt-equity ratio also lowers expected profitability significantly (t=-5.20) while higher current ratio, indicating excess of current assets over current liabilities has a significant positive effect on expected profitability. Capital productivity has a positive influence on expected profitability, with a t-statistic of more than 2.36. This is significant but less than the inflated 2.8 t-statistic used by Fama and French (2000).

These results confirm our hypothesis that variables reflecting firm's size, capital intensity, organisational form, funding structure, and liquidity are important indicators of expected profitability in addition to dividends and market-book ratio (a proxy for Tobin's Q). Thus variations in expected profitability missed by dividend and market-to-book ratio are captured by the additional variables included in our model.

Note that with the inclusion of additional explanators, the expected profitability model (1) gives a better fit. The R^2 reported for equation 1.1 -which is a replication of FF model, is 0.250, 4.11 standard errors from zero, while the R^2 for equation 1.3 which includes organisational structure, gearing, current ratio, and capital productivity as regressors to explain expected profitability is 0.323 with 10.41 standard errors from zero.

- ***Regressions to explain the change in profitability***

Table 2 reports average slopes computed from second-stage estimates of the partial-adjustment model (2) that do not constrain the slopes on expected profitability, $E(Y_{i,t} / A_{i,t})$, and actual profitability, (Y_{it} / A_{it}). The partial-adjustment model would predict that the slope on (Y_{it} / A_{it}) is negative and that on $E(Y_{i,t} / A_{i,t})$ is positive. As shown in table 2, this is exactly what we actually observe. Fama and French (2000) maintain that if there is little error in the prediction of $E(Y_{i,t} / A_{i,t})$ then the two slopes should have equal absolute values. In our analysis, we attempt to examine the behaviour of mean reversion of profitability with different fitted values of $E(Y_{i,t}/A_{i,t})$. We therefore report, in table 2, three sets of equations 2.1 and 2.5 with different fitted values, $E(Y_{i,t}/A_{i,t})$, obtained from our equations 1.1 to 1.3. As mentioned before, equation 1.3 gives a better fit than equation 1.1 and eq. 1.2. Our results confirm the mean reversion hypothesis with average (Y_{it}/A_{it}) and $E(Y_{i,t}/A_{i,t})$ slopes of -0.28 and 0.20 respectively in eq. 2.1. These average slopes are highly significant with t-statistics of –4.54 and 5.28 respectively. With the FF model of expected profitability (eq.1.1), the average rate of mean reversion thus comes out to be 24 % per year.

These results strongly support the emerging consensus that profitability is mean reverting. Our results, however, show less rapid convergence to the mean around 24% for non-listed companies than the estimated rate of 38% per year for the US stock market (Fama and French, 2000). This is comparable to the rate of 25% for the UK listed companies (Allen and Salim, 2002). We also find differences in the rates of mean reversion across sectors, suggesting that the differences in the level of competition and industry characteristics affect the mean reversion. We find that for bigger firms in the transport manufacturing sectors the rate of mean reversion is higher, that is 27% per year, and for the firm engaged in computer consultancy profitability converges at a lower rate of 19 per cent per annum (see Appendix 1 and 2).

Table 1 **Regressions to Explain the Level of Profitability, Y_{it} / A_{it} : 1992-2002** **(Hotels and Restaurants Sector)**

(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	DIV_{it}	DD_{it}	$CAPIN_{it}$	A_{ti}	SUB_{it}	$HOLD_{it}$	$GEAR_{it}$	CUR_{it}	CPR_{it}	R^2	*Obs*
1.1	***Mean***	28.781	0.459	-12.722	66.517	-2.027						0.250	485
	t(Mn)	[5.23]	[1.55]	[-6.33]	[3.07]	[-3.68]						[4.11]	
1.2	*Mean*	27.707	0.524	-15.136	75.252	-2.040	-824.806	29.539				0.279	454
	t(Mn)	[5.55]	[2.05]	[-6.28]	[3.74]	[-3.81]	[-5.20]	[0.09]				[4.33]	
1.3	*Mean*	28.128	2.967	-10.753	50.483	-2.251	-744.660	-420.603	-0.004	0.707	0.117	0.323	402
	t(Mn)	[10.21]	[4.04]	[-4.64[	[4.14]	[-9.98]	[-2.05]	[-1.17]	[-5.21]	[3.90]	[2.36]	[10.41]	

Table 2 **Regressions to Explain the Change in Profitability,** $CP_{i,t+1} = Y_{i,t+1} / A_{i,t+1} - Y_{i,t} / A_{i,t}$

(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	Y_{it}/A_{it}	$E(Y_{it}/A_{it})$	DFE_{it}	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CP_{it}	NCP_{it}	$SNCP_{it}$	$SPCP_{it}$	R^2	*Obs*
2.0.1	***Mean***	-1.352			-0.259				-0.362				0.182	416
	t(Mn)	[-3.83]			[-4.92]				[-3.53]				[5.75]	
2.0.2	*Mean*	-1.327			-0.267				-0.389				0.181	391
	t(Mn)	[-3.84]			[-4.64]				[-2.83]				[5.70]	
2.0.3	*Mean*	-1.330			-0.227				-0.366				0.112	350
	t(Mn)	[-3.25]			[-6.19]				[-2.61]				[5.61]	

Table 2 continued:

Eq.		*Int*	Y_{it}/A_{it}	$E(Y_{i,t}/A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CP_{it}	NCP_{it}	$SNCP_{it}$	$SPCP_{it}$	R^2	*Obs*
2.1.1	*Mean*	-0.282	-0.281	0.197				-0.556				0.192	416
	t(Mn)	[-0.23]	[-4.54]	[5.28]				-2.46				[5.98]	
2.1.2	Mean	-0.242	-0.285	0.197				-0.358				0.189	391
	t(Mn)	[-0.20]	[-4.31]	[5.21]				[-3.02]				[5.99]	
2.1.3	*Mean*	0.450	-0.246	0.095				-0.338				0.125	350
	t(Mn)	[0.43]	[-5.26]	[2.19]				[-2.66]				[6.14]	
2.2	*Mean*	2.815	-0.507					0.178				0.330	1597
	t(Mn)	[3.11]	[-5.51]					[0.59]				[4.64]	
2.3	*Mean*	0.522						-0.418				0.193	1597
	t(Mn)	[0.78]						[-3.45]				[3.74]	
2.4	*Mean*	0.144						-0.285	-0.133	0.001	-0.0002	0.304	1597
	t(Mn)	[0.17]						[-4.13]	[-0.16]	[1.28]	[-0.35]	[4.28]	
2.5.1	*Mean*	0.483	-0.343	0.210	-1.079	0.007	0.011	-0.238	-0.969	0.0004	-0.007	0.299	416
	t(Mn)	[0.27]	[-1.68]	[1.39]	[-0.72]	[1.87]	[1.07]	[-2.30]	[-1.36]	[0.17]	[-1.51]	[7.56]	
2.5.2	*Mean*	-0.214	-0.266	0.104	-0.197	0.009	0.007	0.096	-0.021	0.035	-0.026	0.302	391
	t(Mn)	[-0.13]	[-1.66]	[0.94]	[-0.16]	[2.92]	[1.06]	[0.37]	[-0.02]	[0.97]	[-1.09]	[7.60]	
2.5.3	*Mean*	1.734	-0.509	0.25	-2.612	-0.0005	0.015	0.285	0.936	0.041	-0.037	0.211	350
	t(Mn)	[0.97]	[-2.00]	[1.57]	[-1.38]	[-0.12]	[1.30]	[0.83]	[0.86]	[1.02]	[-1.37]	[5.36]	

Equation 2.1 with the larger number of carefully chosen explanatory variables provides a better fitted $E(Y_{i,t}/A_{i,t})$, and we find that profitability with respect to the observed profitability, Y_{it}/A_{it}, converges to its mean at the rate of 25% (with –5.26 standard errors from zero). However the deviation of expected profitability, $E(Y_{i,t}/A_{i,t})$, moves closer to zero with average slope of .095 (t-statistic of 2.19). This result is intuitive. If we were able to predict the expected profitability more accurately such that the measured expected value of profitability is closer to its mean, then one would find the deviation of $E(Y_{i,t}/A_{i,t})$ moving towards zero.

In order to test whether the partial adjustment term, $DFE_{i,t} = Y_{i,t}/A_{i,t} - E(Y_{i,t}/A_{i,t})$, is the only source of information about the predictable variation in profitability, we include the lagged change in profitability, $CP_{i,t} = Y_{i,t}/A_{i,t} - Y_{i,t-1}/A_{i,t-1}$, as an explanatory variable. Table 2 shows that when CP_{it} is used alone to explain $CP_{i,t+1}$, the slope on CP_{it} is significantly negative; on average, the change in profitability from *t* to *t*+1 reverses 42 % (t = -3.45) of the lagged change (eq. 2.3). Allowing for mean reversion component, Y_{it}/A_{it} and $E(Y_{i,t}/A_{i,t})$ in the regression, moves the slope further from zero, -0.56 (eq. 2.1.1) and to –0.34 if we use better-fitted values of $E(Y_{i,t}/A_{i,t})$ as in eq. 2.1.3. However, t-statistics on CP_{it} are less significant when lagged change in profitability is included in the regression along with the mean reversion term. This suggests some reliable negative autocorrelation in change in profitability beyond what is explained by the partial adjustment term.

The results of present study corroborate the evidence in existing literature (for example, Lev (1969); Fairfield et al. (1996); Fama and French (2000), and Allen and Salim (2002)) that profitability is mean reverting. The simple sectorally undifferentiated economic argument says that competitive forces push profitability toward a common economy-wide mean. In their model, Fama and French (2000) allow differences in expected profitability to vary across firms. The differences in expected profitability across firms could be due to differences in risk. Firms may also differ with respect to historical and replacement costs of assets. These variations in expected profitability can occur even in the face of competition. Firms may also earn different amounts of quasi-permanent rents which tend to persist (Mueller, 1986).

To examine how our estimates of (2) change if we assume all firms revert toward one overall equilibrium level of profitability, we estimate equation (3). Table 2 shows that the estimated rate of mean reversion from (3) jumps to almost double, 51% per year (t=5.51). This shows that in our sample the effect of cross-sectional differences in expected profitability is captured by the grand mean across all firms. This is in contrast to the FF study where rate of mean reversion produced by (2) is higher than (3). They interpret their results to suggest that equation (2) captures meaningful differences across firms in expected profitability.

The third stage of our analysis involves the estimation of equation (4), which includes additional variables intended to examine whether the mean reverting behaviour of profitability is linear or non-linear. Equations 2.4 and 2.5 in table 2 report the estimates of equation (4). In contrast to Fama and French (2000), Elgers and Lo (1994), and Brooks and Buckmaster (1976), we find no evidence that there is nonlinearity in the autocorrelation of changes in profitability as negative changes in profitability, NCP_{it}, squared negative changes, $SNCP_{it}$, and squared positive changes, $SPCP_{it}$ show insignificant t-statistics. Likewise, variables representing negative deviations of profitability from their expected value, $NDFE_{it}$, squared negative deviations, $SNDFE_{it}$, and squared positive deviations, $SPDFE_{it}$, have predicted signs but none (with the exception of $SNDFE_{it}$ in one of the three versions of eq.2.5) are significant. That profitability is non-linear is also true for two other sectors examined in the study (see Appendix 1 and 2). The weaker results for UK firms vis-à-vis non-linearity of mean reversion are similar in direction to those reported by Allen and Salim (2002). Thus, we conclude that there is no support for the economic argument that the rate of mean reversion is higher when profitability is below its mean or when it is far from its mean in either direction.

3. Predicting Earnings

The existing literature on predictability deals mainly with earning rather than profitability. Moreover, the literature is largely skeptical about the economic forces that cause earnings to be predictable. However Freeman et al. (1982) and Lev (1983) and Fama and French (2000) argue that when competitive forces produce mean reversion in profitability, change in earnings become more predictable. This section deals with the same question - whether changes in earnings are predictable and how much of the changes in earnings are due to the mean reversion of profitability? The dependent variable now becomes change in earnings, $CE_{i,t+1} = (Y_{i,t+1} - Y_{i,t}) / A_{i,t}$ instead of change in profitability, $CP_{i,t} = (Y_{i,t} / A_{i,t}) - (Y_{i,t-1} / A_{i,t-1})$. Thus, the only difference between change in earnings and profitability is with respect to change in assets. The regression entails estimation of the following equation:

$$CE_{t+1} = \eta_{0,t} + (\eta_{1,t} + \eta_{2,t} NDFED_{it} + \eta_{3,} NDFED_{it} * DFE_{it} + \eta_{4,t} PDFED_{it} * DFE_{it}) DFE_{it}$$
$$+ (\eta_{5,t} + \eta_{6,t} NCED_{it} + \eta_{7,t} NCED_{it} * CP_{it} + \eta_{8,t} PCED_{it} * CP_{it}) CE_{it} + e_{i,t+1} \quad (5a)$$

$$= \eta_{0,t} + \eta_{1,t} DFE_{it} + \eta_{2,t} NDFE_{it} + \eta_{3,t} SNDFE_{it} + \eta_{4,t} SPDFE_{it}$$
$$+ \eta_{5,t} CE_{it} + \eta_{6,t} NCE_{it} + \eta_{7,t} SNCE_{it} + \eta_{8,t} SPCE_{it} + e_{i,t+1} \quad (5b)$$

The coefficients $\eta_{1,t}, \eta_{2,t}, \eta_{3,t}$ and $\eta_{4,t}$ measure the non-linearity in the mean reversion of profitability while the last four coefficients $\eta_{5,t}, \eta_{6,t}, \eta_{7,t}$ and $\eta_{8,t}$ capture non-linearity in the autocorrelation of changes in earnings. $NCED_{it}$ and $PCED_{it}$ are dummy variables. $NCED_{it}$ is 1 when CE_{it} (the change in earnings from to *t-1* to *t*) is negative and zero otherwise. $PCED_{it}$ is 1 when CE_{it} is positive. The derived variables in the second line of (5b) are negative changes in earnings (NCE_{it}), squared negative changes ($SNCE_{it}$), and squared positive changes ($SPCE_{it}$), as follows:

NCE_{it} is CE_{it} when CE_{it} is negative and zero otherwise;

$SNCE_{it}$ is the square of CE_{it} when CE_{it} is negative and zero otherwise; and

$SPCE_{it}$ is the square of CE_{it} when CE_{it} is positive and zero otherwise.

Our concern is whether changes in earnings are predictable and the extent of these changes attributable to mean-reversion of profitability. The regression results reported in table 3 provide evidence to this question. The model estimated is set out in equation (5) above. In the first row (eq.3.1) we estimate the model with only lagged changes in earnings and find a strong negative autocorrelation in changes in earnings; the slope on CE_{it} is –0.123 (-3.58 standard errors from zero. This is in contrast with previous US studies of Beaver (1970) and Ball and Watts (1972) and the Allen and Salim study on UK stock markets but consistent with Fama and French in terms of evidence of predictability. In the second row (eq.3.2) we include negative changes in earnings, NCE_{it} , we get a strong positive slope of 6.015 (t = 4.0) on NCE_{it} and still get a significant slope on CE_{it} . However, when we introduce non-linearities in changes in earnings, $SNCE_{it}$ and $SPCE_{it}$ (eq.5.3.3), we find none of these dummy variables have significant slopes though NCE_{it} turns negative now as one would expect negative changes to reverse in the light of Elgers and Lo (1994) and Fama and French (2002).

Table 3 **Regressions to Explain the Changes in Earnings,** $CE_{i,t+1} = (Y_{i,t+1} - Y_{i,t}) / A_{i,t}$ **: 1992-2002** **(Hotels and Restaurants)**

(Means and t-statistics for the Means of the yearly regression coefficients)

Eq.		*Int*	Y_{it} / A_{it}	$E(Y_{i,t}/A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CE_{it}	NCE_{it}	$SNCE_{it}$	$SPCE_{it}$	R^2	*Obs*
.3.1	*Mean*	3.416						-0.123				0.021	1597
	t(Mn)	[3.53]						[-3.58]				[2.66]	
3.2	*Mean*	0.812						-0.100	6.015			0.028	1597
	t(Mn)	[0.81]						[-2.68]	[4.00]			[4.23]	
3.3	*Mean*	2.597						-0.294	2.245	-0.001	0.001	0.085	1597
	t(Mn)	[2.28]						[-3.1]	[1.92]	[-0.38]	[1.73]	[3.27]	
3.4.1	*Mean*	2.31	-0.416	0.443				-0.979	-2.227	-0.026	0.022	0.265	729
	t(Mn)	[1.29]	[-2.17]	[2.22]				[-1.92]	[-1.93]	[-1.41]	[1.62]	[2.25]	
3.4.2	*Mean*	1.117	-0.199	0.202				-0.478	-0.929	-0.008	0.010	0.139	391
	t(Mn)	[0.69]	[-2.83]	[3.29]				[-1.89]	[-1.52]	[-0.78]	[1.15]	[6.51]	
3.4.3	*Mean*	1.344	-0.220	0.212				-0.487	-0.529	-0.029	0.011	0.100	350
	t(Mn)	[1.26]	[-3.73]	[4.18]				[-1.36]	[-0.59]	[-0.96]	[0.87]	[7.87]	
3.5.1	*Mean*	1.605	-0.027	0.047	-1.507	0.017	-0.005	-0.609	-1.661	-0.023	0.014	0.234	416
	t(Mn)	[0.61]	[-0.20]	[0.28]	[-0.70]	[2.29]	[-1.02]	[-1.64]	[-1.78]	[-1.03]	[1.03]	[4.98]	
3.5.2	*Mean*	1.950	0.026	-0.030	-1.305	0.018	-0.009	-0.603	-1.595	-0.021	0.014	0.234	391
	t(Mn)	[0.74]	[0.19]	[-0.16]	[-0.70]	[2.24]	[-1.03]	[-1.57]	[-1.71]	[-1.02]	[1.01]	[4.75]	
3.5.3	*Mean*	3.055	-0.327	0.252	-3.192	0.007	0.009	-0.464	-0.903	-0.034	0.010	0.165	350
	((Mn)	[1.49]	[-0.96]	[0.75]	[-1.30]	[0.45]	[0.82]	[-1.35]	[-1.08]	[-0.99]	[0.80]	[6.67]	

The lagged change in earnings, however, remains significant with a slope of –0.294 (t=-3.1). This is in line with Allen and Salim (2002) who also report that the inclusion of dummy variables on earnings change the net results.

Table 3 shows that when we include the linear mean reversion variables Y_{it} / A_{it} and $E(Y_{i,t} / A_{i,t})$ to the regression in addition to the four autocorrelation variables, we find strong evidence that mean reversion leads to predictable variation in earnings. As in table 2, we report three versions of the equations (3.4 and 3.5) in table 3, with three sets of different fitted values of expected profitability ($E(Y_{i,t} / A_{i,t})$ obtained from regression estimates of model equation (5.1). As can be seen in table 3, with the closer fitted model (eq.5.3.4.3) the slopes on Y_{it} / A_{it} and $E(Y_{i,t} / A_{i,t})$ are very significant; -0.220 and 0.212 (-3.73 and 4.18 standard errors from zero) providing evidence that mean reversion in profitability leads to predictable variation in earnings. This is consistent with Fama and French (2000); however in contrast, we do not find significant average slopes on the autocorrelations variables. Finally, we estimate the unrestricted model specified in equation (5) and allow non-linear mean reversion of profitability by adding $NDFE_{it}$, $SNDFE_{it}$ and $SNDFE_{it}$ in the regressions. This shifts the slopes on all the autocorrelation variables closer to zero and, except for $SNDFE_{it}$, all the variables in equation (5) have insignificant t-statistics. The results of the last set of regressions are weaker than those of Fama and French (2000) but similar to Allen and Salim (2002). As suggested by FF, our regressions (equation 5) imply that the unconditional expected earnings growth is the same across all firms. However, unconditional expected earnings growth differs across firms. In our model, the variation in expected earnings growth seems to have been picked up by the lagged change in earnings – although its behaviour is noisy in the estimates of equation (5). Perhaps, the model should allow for variation across firms in expected earnings growth for a more complete story for the predictable variation in earnings. However, our main concern in this study is profitability- not earnings, and the interesting issue is whether competition produces mean reversion in profitability.

4. Predicting Corporate Taxes

In this section we extend our analysis to examine whether corporate taxes are predictable and the extent of their predictability. Since corporate taxes depend by and large on earnings of firms and, given that changes in earnings are driven by mean reversion of profitability, it should be interesting to identify the drivers of changes in corporate taxes. We consider three factors: changes in corporate taxes are expected to be autoregressive (as demonstrated empirically in Ahmed (2004), and so predictability of corporate taxes should be due to past changes in taxes themselves. In addition, changes in earnings, lagged profitability, and lagged changes in profitability should explain variations in corporate taxes from year *t* to year *t*+1. Finally, as in previous sections, we are also interested in testing whether there is a non-linearity in behaviour of corporate taxes.

To this end, our partial adjustment model for corporate taxes is:

$$CT_{t+1} = \delta_{0,t} + \delta_{1,t} CT_{it} + \delta_{2,t} X_{it,j} + \delta_{3,t} NCT_{it} + \delta_{4,t} SNCT_{it} + \delta_{5,t} SPCT_{it} + \varphi_{t+1} \qquad (6)$$

$$X_{it,j} \in \{CE_{it}, CP_{it}, Y_{it} / A_{it}\}$$

CT_{it} is the change in corporate taxes (T), normalized by size (A) paid by firm *i*, from year *t*-1 to *t*. $CT_{it} = (T_{i,t} - T_{i,t-1}) \,/ A_{i,t-1}$. $NCT_{it}, SNCT_{it}$ and $SPCT_{it}$ are dummy variables:

NCT_{it} is CT_{it} when CT_{it} is negative and zero otherwise;

$SNCT_{it}$ is the square of CT_{it} when CT_{it} is negative and zero otherwise; and

$SPCT_{it}$ is the square of CT_{it} when CT_{it} is positive and zero otherwise.

The coefficient $\delta_{1,t}$ measures the speed of adjustment of corporate taxes, $\delta_{2,t}$ measures the impact of changes in earnings and profitability, and lagged profitability on corporate tax liabilities, and the last three coefficients $\delta_{3,t}, \delta_{4,t}$ and $\delta_{5,t}$ capture non-linearity in the autocorrelation of changes in corporate taxes. We estimate three variants of equation (6) to avoid collinearity between changes in earnings, changes in profitability, and profitability observed in the lagged period. As we have seen that changes in both earnings and profitability are driven by mean reversion of profitability, and lagged changes in profitbaility, we use these variables separately in our estimations of changes in taxes.

Table 4 reports the results on average slopes obtained by year-by-year regressions to explain changes in corporate taxes, scaled by total assets.

Table 4: Regressions to Explain the Changes in Corporate taxes

$CT_{i,t+1}/A_{i,t} = T_{i,t+1}/A_{i,t+1} - T_{i,t}/A_{i,t}$ **: 1992-2002**

(Means and t-statistics for the Means of the yearly regression coefficients)

(Hotels and Restaurants Sector)

	Int	$CT_{it}/A_{i,t}$	Y_{it}/A_{it}	CP_{it}	CE_{it}	NCT_{it}	$SNCT_{it}$	$SPCT_{it}$	R^2	Obs
Mean	0.0022	-0.395	-0.00002			-0.0037	-2.5648	-1.012	0.319	747
t(Mn)	[1.88]	[-2.07]	[-0.16]			[-1.35]	[-1.29]	[-1.96]	[2.90]	
Mean	0.0016	-0.471		0.00015		-0.0039	-2.8321	-0.898	0.304	709
t(Mn)	[0.98]	[-2.68]		[2.36]		[-1.49]	[-1.54]	[-1.66]	[2.81]	
Mean	0.001	-0.460			0.00014	-0.0037	-2.937	-0.910	0.301	708
t(Mn)	[0.85]	[-2.56]			[2.83]	[-1.47]	[-1.58]	[-1.72]	[2.72]	

Three important results stand out: (1) Changes in corporate taxes follow an autoregressive process. In all the regressions, the negative autocorrelation in changes in corporate taxes is very strong with slopes ranging between –0.40 to –0.47 (and t-statistics between –2.07 to –2.68). Thus, on an average 44% adjustment in corporate taxes takes place in the following period. (2) Changes in corporate taxes are driven by changes in earnings. However, there is little evidence that lagged profitability influences changes in corporate tax payments. Thus, changes in earnings is the strongest driving force, besides lagged changes in corporate taxes, in explaining variations in tax payments of the firms. (3) Unlike the predictability of profitability and earnings, we find some nonlinearity in the behaviour of corporate taxes. The average slopes of NCT_{it} and $SNCT_{it}$ are statistically insignificant, suggesting that there is no nonlinearity in the autocorrelation of negative changes in corporate taxes paid by the firms in our sample. However, squared positive changes in taxes in period $t, SPCT_{it}$, have significant, negative influence on changes in the corporate tax payments of the following period. This is true for two sectors (hotels and restaurants and computer consultancy) examined in our study. This suggests that for more extreme positive changes in corporate taxes, reversal from past corporate taxes is faster.

These findings may inform changes in the way forecasts of corporate tax revenues are made in the UK. The current methods employed in the UK rely a great deal on microsimulation methods which are prone to errors. Instead, the evidence that profitability reverts to its mean within and across industries, and that changes in earnings are in part influenced by this mean reversion of profitability helped in our exercise of forecasting taxes by forecasting earnings liable to tax. Suppose the fraction of earnings a company pays taxes on is noisy around some mean (which might be a function of the level of earnings), then one might estimate taxes more accurately by forecasting earnings (and applying a constant factor) than by forecasting the noisy tax process directly.

5. Conclusions

This paper has provided further evidence on the standard economic argument that, in competitive markets, profitability is mean reverting. Our evidence is in line with this prediction and supports the evidence in the existing literature. Like profitability, we find that variations in earnings are also predictable and that this is mainly due to mean reversion of profitability. Again, the evidence supports Fama and French. We provide further insight into the argument and show that like profitability and earnings, corporate taxes payable on firm earnings are also predictable.

The figure in Appendix 3 summarises the causal (linear) links between the factors that significantly impact on changes in profitability, earnings and corporate taxes.

For a sample of listed and non-listed UK companies, we find strong support for the extant view that profitability reverts to its mean within and across industries. Our results show that while there are no significant differences in the patterns of mean reversion, there are considerable differences in their rates across the three diverse industrial sectors examined in our research. This is due, mainly, to the differences in the level of competition and the industry characteristics. We find that profits revert to the mean at the rate of 24% per year for the hotels and restaurants sector. The transport manufacturing sector is populated by bigger firms and in this case the rate is slightly higher, that is, 27% per year. For firms engaged in computer consultancy, profitability converges at the lower rate of 19 per cent per annum. Unlike previous study on US stock market, our results do not suggest that mean reversion is nonlinear. That non-linearities in profitability are insignificant is true for all the three industries studied. Moreover, we have shown that expected profitability of individual firms is explained by such variables as firm size, capital intensity, funding structure, debt sustainability, capital productivity and organisational structure, in addition to market-to-book value ratio (Tobin’s q) and dividends. The profitability of listed firms and larger companies such as those in the transport manufacturing sector are better explained with the inclusion of the Tobin’s q measure and dividend payouts. We have also demonstrated that closer fitted models of profitability lower the rate of mean reversion.

Overall, we have shown that variation in earnings can be explained by the notion of mean reversion in profitability and there is significant evidence on autocorrelation of earnings. The evidence suggests that corporate taxes follow an autoregressive process and that changes in corporate tax payments owe much to changes in earnings.

These results have implications for the security analysts, capital owners, tax authorities and the treasury.

Appendix 1

PART A **Regressions to Explain the Level of Profitability, Y_{it} / A_{it} : 1992-2002** ***(TRANSPORT MANUFACTURING)***

(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	*DIV* $_{it}$	V_{it} / A_{it}	*CAPIN*$_{it}$	A_{ti}	R^2	*Obs*
.1	*Mean*	0.298	55.797	1.002	-93.961	0.363	0.608	14
	t (Mn)	[0.02]	2.40	[1.23]	[-4.10]	[0.32]	[5.44]	

PART B **Regressions to Explain the Change in Profitability, $CP_{i,t+1} = Y_{i,t+1} / A_{i,t+1} - Y_{i,t} / A_{i,t}$**

(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	Y_{it} / A_{it}	$E(Y_{i,t} / A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CP_{it}	NCP_{it}	$SNCP_{it}$	$SPCP_{it}$	R^2	*Obs*
2.1.	*Mean*	-3.588	-0.291	0.249				-0.407				0.344	13
	t(Mn)	[-2.99]	[3.45]	[1.64]				[-3.75]				[3.11]	
2.2	*Mean*	-0.360	-0.390					-0.088				0.198	694
	t(Mn)	[-0.36]	[-5.72]					[-1.55]				[4.88]	
2.3	*Mean*	-2.589						-0.267				0.083	694
	t(Mn)	[-2.04]						[-3.56]				[3.05]	
2.4	*Mean*	-3.232						-0.301	-0.019	0.0011	0..0005	0.144	694
	t(Mn)	[-1.69]						[-2.21]	[-0.01]	[0.99]	[0.92]	[4.09]	
2.5.	*Mean*	-7.565	3.093	-3.150	13.102	0.310	-0.426	0.825	6.715	0.056	-0.366	0.818	13
	t(Mn)	[1.33]	[2.07]	[-1.96]	[1.33]	[0.72]	[-1.66]	[0.66]	[1.47]	[0.72]	[-0.76]	[13.27]	

Appendix 1 continued

PART C: Regressions to Explain the Changes in Earnings, $CE_{i,t+1} = (Y_{i,t+1} - Y_{i,t}) / A_{i,t}$: 1992-2002

(Means and t-statistics for the Means of the yearly regression coefficients)

Eq.		Int	Y_{it} / A_{it}	$E(Y_{i,t}/A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CE_{it}	NCE_{it}	$SNCE_{it}$	$SPCE_{it}$	R^2	Obs
3.1	*Mean*	1.267						-0.130				0.050	693
	t(Mn)	[1.09]						[-2.37]				[2.34]	
3.2	*Mean*	-1.422						-0.113	5.571			0.055	693
	t(Mn)	[-1.45]						[-1.92]	[3.42]			[2.71]	
3.3	*Mean*	-0.042						-0.264	2.538	-0.0005	0.008	0.100	693
	t(Mn)	[-0.03]						[-3.17]	[1.68]	[-1.92]	[0.96]	[3.44]	
3.4.	*Mean*	-9.862	-0.030	0.264				-0.035	5.304	0.230	0.482	0.639	13
	t(Mn)	[-2.13]	[-0.07]	[0.45]				[-0.07]	[0.88]	[0.96]	[1.86]	[6.55]	
3.5	*Mean*	16.083	4.636	-4.239	15.336	2.001	-0.751	-0.047	6.143	0.220	0.966	0.803	13
	t(Mn)	[-2.84]	[2.06]	[-1.77]	[1.82]	[1.23]	[-1.72]	[-0.04]	[0.86]	[0.99]	[1.57]	[18.08]	

PART D: Regressions to Explain the Changes in Corporate taxes $CT_{i,t+1} / A_{i,t} = T_{i,t+1} / A_{i,t+1} - T_{i,t} / A_{i,t}$: 1992-2002

(Means and t-statistics for the Means of the yearly regression coefficients)

Eq.		Int	$CT_{it} / A_{i,t}$	Y_{it} / A_{it}	CP_{it}	CE_{it}	NCT_{it}	$SNCT_{it}$	$SPCT_{it}$	R^2	Obs
4.1	*Mean*	0.011	-0.292	0.0002			-0.006	-11.935	0.414	0.214	369
	t(Mn)	[0.576]	[-1.41]	[0.658]			[-0.88]	[-1.063]	[0.289]	[5.86]	
4.2	*Mean*	0.005	-0.393		0.0003		-0.0078	-11.896	0.144	0.221	351
	t(Mn)	[1.33]	[-2.04]		[1.02]		[-1.07]	[-1.05]	[0.09]	[5.32]	
4.3	*Mean*	0.002	-0.426			0.0004	-0.006	-11.859	0.136	0.246	351
	t(Mn)	[0.59]	[-3.01]			[1.59]	[-1.07]	[-1.05]	[0.09]	[5.71]	

Appendix 2

PART A **Regressions to Explain the Level of Profitability, Y_{it} / A_{it} : 1992-2002** **(*COMPUTER CONSULTANCY SECTOR)***
(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	DIV_{it}	$CAPIN_{it}$	A_{ti}	SUB_{it}	$HOLD_{it}$	$GEAR_{it}$	CUR_{it}	CPR_{it}	R^2	*Obs*
.1	*Mean*	116.657	11.016	97.946	-11.806	6228.6	-9806.8	-0.063	-2.038	-0.340	0.695	77
	t (Mn)	[3.88]	2.37	[1.08]	[-3.73]	[0.77]	[-2.24]	[-2.98]	[-0.55]	[-0.99]	[12.15]	

PART B **Regressions to Explain the Change in Profitability,** $CP_{i,t+1} = Y_{i,t+1} / A_{i,t+1} - Y_{i,t} / A_{i,t}$
(Means & t-statistics for the Means of the Yearly Regression Coefficients)

Eq.		*Int*	Y_{it} / A_{it}	$E(Y_{i,t}/A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CP_{it}	NCP_{it}	$SNCP_{it}$	$SPCP_{it}$	R^2	*Obs*
2.1.	*Mean*	-3.017	-0.270	0.099				-0.103				0.308	49
	t(Mn)	[-0.86]	[-2.12]	[1.66]				[-0.45]				[3.90]	
2.2	*Mean*	1.310	-0.225					-0.211				0.197	229
	t(Mn)	[0.51]	[-2.88]					[-2.84]				[4.47]	
2.3	*Mean*	-8.618						-0.251				0.085	229
	t(Mn)	[-2.72]						[-6.36]				[2.19]	
2.4	*Mean*	-5.246						-0.291	-6.496	0.001	0.0005	0.165	229
	t(Mn)	[-1.56]						[-2.22]	[-1.69]	[-0.28]	[-0.87]	[2.97]	
2.5.	*Mean*	-4.179	-0.389	0.235	-7.307	0.0001	-0.001	-0.051	6.022	0.004	0.028	0.529	49
	t(Mn)	[-0.64]	[-0.65]	[0.46]	[-0.76]	[-0.01]	[0.05]	[-0.14]	[0.85]	[1.68]	[1.03]	[5.37]	

Appendix 2 continued

PART C: Regressions to Explain the Changes in Earnings, $CE_{i,t+1} = (Y_{i,t+1} - Y_{i,t}) / A_{i,t}$: 1992-2002

(Means and t-statistics for the Means of the yearly regression coefficients)

Eq.		Int	Y_{it} / A_{it}	$E(Y_{i,t}/A_{i,t})$	$NDFE_{it}$	$SNDFE_{it}$	$SPDFE_{it}$	CE_{it}	NCE_{it}	$SNCE_{it}$	$SPCE_{it}$	R^2	Obs
3.1	*Mean*	6.440						-0.128				0.113	228
	t(Mn)	[2.05]						[-2.05]				[1.84]	
3.2	*Mean*	-3.728						-0.095	20.098			0.090	228
	t(Mn)	[-1.40]						[-1.52]	[2.40]			[3.11]	
3.3	*Mean*	3.806						-0.246	4.435	0.002	0.00003	0.164	228
	t(Mn)	[1.56]						[-1.98]	[0.66]	[1.00]	[0.04]	[3.03]	
3.4.	*Mean*	-5.342	-0.084	0.060				0.357	12.613	0.016	-0.011	0.344	49
	t(Mn)	[1.19]	[-0.70]	[0.51]				[0.96]	[1.51]	[1.20]	[-1.52]	[6.03]	
3.5	*Mean*	3.071	-0.395	0.303	-16.642	0.002	0.002	0.330	11.693	0.011	-0.009	0.425	49
	t(Mn)	[0.330]	[-0.85]	[0.73]	[-1.21]	[0.28]	[0.35]	[1.12]	[1.57]	[1.07]	[-1.69]	[7.45]	

PART D: Regressions to Explain the Changes in Corporate taxes $CT_{i,t+1} / A_{i,t} = T_{i,t+1} / A_{i,t+1} - T_{i,t} / A_{i,t}$: 1992-2002

(Means and t-statistics for the Means of the yearly regression coefficients)

Eq.		Int	$CT_{it} / A_{i,t}$	Y_{it} / A_{it}	CP_{it}	CE_{it}	NCT_{it}	$SNCT_{it}$	$SPCT_{it}$	R^2	Obs
4.1	*Mean*	-0.007	-0.381	0.0002			-0.011	-1.622	-0.911	0.374	192
	t(Mn)	[-1.02]	[-3.76]	[0.72]			[-1.33]	[-1.61]	[-1.82]	[2.99]	
4.2	*Mean*	0.005	-0.391		0.0002		-0.0011	-0.737	-0.915	0.346	178
	t(Mn)	[0.48]	[-4.60]		[0.52]		[-1.25]	[-0.89]	[-1.75]	[2.70]	
4.3	*Mean*	-0.001	-0.407			0.00007	-0.006	-1.320	-0.836	0.335	178
	t(Mn)	[-0.22]	[-2.71]			[1.11]	[-1.11]	[-1.24]	[-1.83]	[2.58]	

Appendix 3

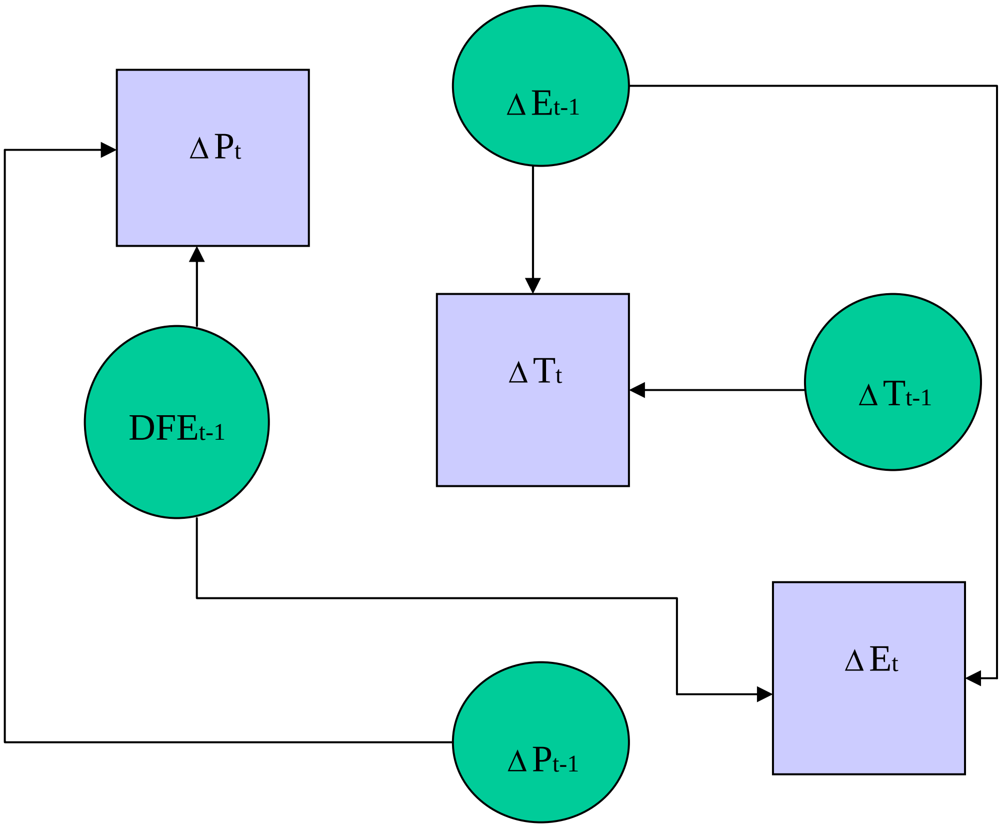

Figure: Causal linear relationship between profitability, earnings, and corporate taxes.

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